

CLAIMS

WHAT IS CLAIMED IS:

1. An electrically actuated fail-safe valve for controlling fluid flow in a deepwater drilling operation, comprising:

a body having a bore therethrough;

a closure element mounted in the bore and actuatable between a closed position in which said bore is relatively obstructed and an open position in which said bore is relatively open, said closure element being biased to one of said closed and open positions;

a flow tube slidably mounted in said bore, said flow tube being actuatable between a first position in which said flow tube does not interfere with the normal bias of said closure element and a second position in which said flow tube opposes the normal bias of said closure element so as to maintain said closure element in the other of said closed and open positions;

an electrically powered drive mechanism mounted in said body and engaging said flow tube so as to advance said flow tube from said first position to said second position.

2. The valve according to claim 1 wherein said closure element is biased into said closed position and said drive mechanism advances said flow tube such that said flow tube actuates said closure element to said open position.

3. The valve according to claim 1, further including a plurality of powered drive mechanisms, said drive mechanisms including one-way drive clutches and allowing nonfunctioning drive mechanisms to be mechanically decoupled.

4. The valve according to claim 1 wherein the drive mechanism comprises:

a gear drive,

a rotating sleeve mounted in said body, said rotating sleeve including a helical groove, and

a follower pin mounted on said flow tube and received in said helical groove;

such that electrical power supplied to said gear drive causes said rotating sleeve to rotate, which in turn bears on said follower pin and advances said flow tube to said second position.

5. The valve according to claim 4 wherein the helical groove includes a straight portion substantially parallel to the longitudinal axis of said bore.

6. The valve according to claim 4 wherein the helical groove includes a transverse portion substantially perpendicular to the longitudinal axis of said bore.

7. The valve according to claim 4, further including means for preventing longitudinal rotation of said flow tube.

8. The valve according to claim 1, further including an electrically actuable retaining mechanism mounted in said body and actuable between an engaged position in which said retaining mechanism engages said flow tube and prevents axial movement of said flow tube relative to said body and a disengaged position in which said retaining mechanism allows axial movement of said flow tube relative to said body.

8. The valve according to claim 1, further including a biasing means urging said flow tube into said first position.

9. An electrically actuated fail-safe valve for controlling fluid flow in a deepwater drilling operation, comprising:

a body having a bore therethrough;

a closure element mounted in the bore and actuable between a closed position in which said bore is relatively obstructed and an open position in which said bore is relatively open, said closure element being biased to said closed position;

a flow tube slidably mounted in said bore, said flow tube being actuable between a first position in which said flow tube does not interfere with the normal bias of said closure element and a second position in which said flow tube opposes the normal bias of said

closure element so as to maintain said closure element in the other of said closed and open positions;

an electrically powered drive mechanism mounted in said body and engaging said flow tube so as to advance said flow tube from said first position to said second position such that said flow tube actuates said closure element to said open position, said drive mechanism comprising:

a gear drive,

a rotating sleeve mounted in said body, said rotating sleeve including a helical groove, and

a follower pin mounted on said flow tube and received in said helical groove;

wherein power supplied to said gear drive causes said rotating sleeve to rotate, which in turn bears on said follower pin and advances said flow tube to said second position.

10. The valve according to claim 1, further including a plurality of powered drive mechanisms, said drive mechanisms including one-way drive clutches and allowing nonfunctioning drive mechanisms to be mechanically decoupled.

11. The valve according to claim 9 wherein the helical groove includes a straight portion substantially parallel to the longitudinal axis of said bore.

12. The valve according to claim 9 wherein the helical groove includes a transverse portion substantially perpendicular to the longitudinal axis of said bore.

13. The valve according to claim 9, further including means for preventing longitudinal rotation of said flow tube.

14. The valve according to claim 9, further including an electrically actuable retaining mechanism mounted in said body and actuable between an engaged position in which said retaining mechanism engages said flow tube and prevents axial movement of said flow tube relative to said body and a disengaged position in which said retaining mechanism allows axial movement of said flow tube relative to said body.

15. The valve according to claim 9, further including a biasing means for urging said flow tube into said first position.

16. A method for controlling fluid flow in a deepwater drilling operation, comprising:

- a) providing a tool having a bore therethrough, the tool including a closure element actuable between a closed position in which the closure element closes said bore and an open position in which the closure element allows fluid flow through the bore, the closure element being biased normally closed, the tool further including a flow tube slidably mounted in said bore, the flow tube being actuable between a first position in which the flow tube does not prevent the closure element from being in its normally biased position and a second position in which the flow tube opposes the normal bias of the closure element so as to actuate the closure element to the open position;
- b) selectively actuating said flow tube so as to actuate the closure element to the open position.

17. The method according to claim 16 wherein the tool further includes a rotating sleeve and a follower pin extending from the flow tube and engaging a helical groove in said rotating sleeve and wherein the actuating step comprises rotating the sleeve such that engagement of the follower pin in the helical groove advances the flow tube from the first position to the second position.

18. The method according to claim 16 wherein the tool further comprises a releasable locking mechanism and said helical groove includes a longitudinal straight portion such that when the follower pin lies in the longitudinal straight portion of the groove and the locking mechanism is released, the biasing of the closure element causes the flow tube to move to the first position.

19. The method according to claim 18 wherein the locking mechanism is electrically actuated.
20. The method according to claim 16 wherein the flow tube is actuated using electrical power.